

IN THE CLAIMS

Please enter the following amendments to the claims.

We claim:

1. (currently amended) A method of processing a wafer comprising:
placing a wafer in a single wafer cleaning tool;
spinning said wafer in said single wafer cleaning tool; ~~and~~
applying acoustic waves to said wafer; and
exposing said wafer to a solution comprising:
NH₄OH;
H₂O₂;
H₂O; and
a chelating agent comprising ethylenediaminediortho-hydroxyphenylacetic acid (EDDHA), wherein said wafer is exposed to said solution for a time in the approximate range of 30 seconds and 90 seconds while spinning said wafer and applying acoustic waves to said wafer.
2. (cancelled)
3. (original) The method of claim 1 wherein said chelating agent is a carboxylic acid.
4. (original) The method of claim 1 further comprising cleaning a front side of said wafer with said cleaning solution while cleaning a back side of said wafer with a solution different from said cleaning solution.
5. (cancelled)
6. (currently amended) The method of claim ~~[[5]]~~ 1 wherein said acoustic waves are megasonic.
7. (original) The method of claim 1 further comprising dissolving a cavitation gas into said cleaning solution.

8. (original) The method of claim 7 wherein said cavitation gas is chosen from the group H₂, N₂, O₂, O₃, Ar, and He.

9. (original) The method of claim 1 further comprising a thermal processing step at a temperature exceeding 400°C after cleaning said wafer.

10. (original) The method of claim 9 wherein said thermal processing step is an anneal step.

11. (original) The method of claim 9 wherein said thermal processing step is a chemical vapor deposition step.

12. (original) The method of claim 9 wherein said thermal processing step is an oxidation step.

13. (previously presented) The method of claim 1 further comprising removing a photoresist from said wafer with an O₂ ashing step before placing said wafer in said single wafer cleaning tool.

14. (cancelled)

15. (original) The method of claim 1 wherein said solution is further comprises a surfactant.

16. (original) The method of claim 15 wherein said surfactant is 1-100ppm of said solution.

17. (original) The method of claim 15 wherein said surfactant is non-ionic.

18. (original) The method of claim 15 wherein said surfactant is anionic.

19. (original) The method of claim 15 wherein said surfactant is a mixture of non-ionic and anionic compounds.

20. (original) The method of claim 17 wherein said non-ionic surfactant is polyoxyethylene butylphenyl ether.

21. (original) The method of claim 18 wherein the anionic surfactant is polyoxyethylene alkylphenyl sulfate.

22. (original) The method of claim 17 wherein said non-ionic surfactant is 30ppm of said solution.

23. (original) The method of claim 9 wherein said anionic surfactant is 30ppm of said solution.

24. (cancelled)

25. (cancelled)

26. (cancelled)

27. (cancelled)

28. (cancelled)

29. (cancelled)

30. (cancelled)

31. (cancelled)

32. (cancelled)

33. (cancelled)

34. (cancelled)

35. (cancelled)

36. (cancelled)

37. (cancelled)

38. (cancelled)

39. (cancelled)

40. (cancelled)

41. (original) A method of cleaning a wafer comprising:
etching said wafer with a hydrogen fluoride solution;
after etching said wafer, rinsing said wafer with a first rinse;
after rinsing said wafer with said first rinse, cleaning said wafer with a cleaning
solution comprising:
 NH_4OH ;
 H_2O_2 ;
 H_2O ;
 a chelating agent; and
 a surfactant;
after cleaning said wafer with said cleaning solution, rinsing said wafer with a second
rinse;
after said rinsing of said wafer with said second rinse, drying said wafer; and
wherein said processing is done within 3 minutes.

42. (original) The method of claim 41 wherein said processing is done in less than or
equal to two minutes.

43. (original) The method of claim 41 wherein said etching is done within 30 seconds.

44. (original) The method of claim 41 wherein said first rinse is done within 20 seconds.
45. (original) The method of claim 41 wherein said cleaning is done within 30 seconds.
46. (original) The method of claim 41 wherein said second rinse is done within 20 seconds.
47. (original) The method of claim 41 wherein said drying is done within 20 seconds.
48. (original) The method of claim 41 wherein during said etching of said wafer an etching solution is applied to a front side of said wafer and a solution different from said etching solution is applied to a back side of said wafer.
49. (original) The method of claim 41 wherein during said first rinse of said wafer a rinsing solution is applied to a front side of said wafer and a solution different from said rinsing solution is applied to a back side of said wafer.
50. (original) The method of claim 41 wherein during said cleaning of said wafer said cleaning solution is applied to a front side of said wafer and a solution different from said cleaning solution is applied to a back side of said wafer.
51. (original) The method of claim 41 wherein during said second rinse of said wafer a rinsing solution is applied to a front side of said wafer and a solution different from said rinsing solution is applied to a back side of said wafer.
52. (currently amended) A method of ~~forming a rinse~~ rinsing a wafer comprising:
degassing H₂O; ~~and~~
dissolving a gaseous oxidant comprising O₂ or O₃ into said H₂O to form a rinse at a point of use of said rinse; and
applying said rinse to said wafer within a single wafer cleaning tool to oxidize Cu⁺ on said wafer.

53. (currently amended) The method of claim 52 ~~wherein said H₂O is deionized~~ further comprising cleaning said wafer with a cleaning solution comprising NH₄OH, H₂O₂, H₂O, and a chelating agent after applying said rinse to said wafer.
54. (cancelled)
55. (cancelled)
56. (original) The method of claim 52 wherein said gaseous oxidant is dissolved in said water at point of use.
57. (original) The method of claim 52 wherein said gaseous oxidant is dissolved in said water by a venturi apparatus.
58. (original) The method of claim 52 wherein said gaseous oxidant is dissolved in said water by passing said rinse along a hydrophobic membrane that allows gases through but not said rinse.
59. (previously presented) A method of cleaning a wafer comprising:
cleaning said wafer with a first solution comprising a chelating agent and a surfactant;
after cleaning said wafer, rinsing said wafer with a second solution comprising water and an oxidizing agent.
60. (original) The method of claim 59 wherein said oxidizing agent is chosen from the group: O₃, O₂, and H₂O₂.
61. (original) The method of claim 59 wherein said oxidizing agent is present in said second solution in a concentration sufficient to oxidize Cu²⁺.
62. (original) The method of claim 59 wherein said concentration of said oxidizing agent is greater than 1ppm.
63. (original) The method of claim 59 wherein said concentration of said oxidizing agent is greater than 100ppm.

64. (original) The method of claim 59 wherein said second solution has a standard oxidation potential greater than 0.5V.

65. (original) The method of claim 59 wherein said water is degasified before said oxidizing agent is added to said water.

66. (original) The method of claim 59 wherein said water is deionized.

67. (currently amended) A method of processing a wafer comprising:
placing said wafer in a single wafer cleaning tool;
after placing said wafer in said single wafer cleaning tool, dispensing an HF solution on said wafer for between 2-3 seconds to etch approximately 0.5Å – 5Å of a thermal oxide on said wafer;
removing said HF solution from said wafer by spinning said wafer at a high spin rate;
and
dispensing a cleaning solution on said wafer immediately after dispensing said HF solution to neutralize said HF solution.

68. (original) The method of claim 67 further comprising spinning said wafer during said processing .

69. (original) The method of claim 67 wherein while said HF solution is dispensed on a first side of said wafer, a solution different from said HF solution is dispensed on a second side of said wafer.

70. (original) The method of claim 67 wherein megasonics are applied to said wafer when said cleaning solution is dispensed on said wafer.

71. (original) The method of claim 67 wherein said wafer has a surface with an oxide layer.

72. (original) The method of claim 71 wherein said hydrofluoric acid solution is dispensed on said surface with said oxide layer.

73. (original) The method of claim 72 wherein said hydrofluoric acid solution etches said oxide layer to a thickness of between 1Å and 8Å.

74. (original) The method of claim 67 wherein said cleaning solution comprises:

NH₄OH;

H₂O₂;

H₂O;

a chelating agent; and

a surfactant.

75. (original) The method of claim 67 wherein said cleaning solution is on said wafer for less than 30 seconds.

76. (original) The method of claim 67 wherein said cleaning solution is dispensed on said HF covered wafer for a time sufficient to neutralize said HF solution.

77. (original) The method of claim 67 wherein said HF solution comprises water and hydrofluoric acid.

78. (original) The method of claim 67 wherein said HF solution comprises water and buffered hydrofluoric acid.

79. (original) A method of processing a wafer comprising:

placing a wafer having a first side and a second side in a single wafer cleaning tool;

after placing said wafer in said cleaning tool, dispensing an HF solution on said first side of said wafer for 2-3 seconds to produce an HF covered first side of said wafer;

simultaneous to dispensing said HF solution on said first side of said wafer,

dispensing a solution different from said HF solution on said second side of said wafer; and

after dispensing said HF solution on said first side of said wafer, dispensing a cleaning solution comprising:

NH₄OH;

H₂O₂;

H₂O;

a chelating agent; and
a surfactant,
on said HF covered first side of said wafer.

80. (previously presented) A method of processing a wafer comprising:
placing a wafer with a first side with a hydrophilic surface and a second side in a single wafer cleaning tool;
after placing said wafer in said single wafer cleaning tool, spinning said wafer;
while spinning said wafer, dispensing an HF solution on said first side of said wafer for a time short enough to leave said hydrophilic surface on said first side of said wafer;
simultaneous to dispensing said HF solution on said first side of said wafer, dispensing a solution different from said HF solution on said second side of said wafer; and
after dispensing said HF solution on said first side of said wafer, dispensing a cleaning solution on said first side of said wafer.

81. (original) The method of claim 80 wherein said cleaning solution comprises:
 NH_4OH ;
 H_2O_2 ;
 H_2O ;
a chelating agent; and
a surfactant.

82. (original) The method of claim 80 wherein said HF solution is dispensed on said wafer for a time sufficient to leave a concentration of less than 5×10^{10} atoms/cm² of aluminum on said wafer.

83. (original) A method of processing a wafer comprising:
etching a wafer with an HF solution;
after etching said wafer, cleaning said wafer with a solution comprising:
 NH_4OH ;
 H_2O_2 ;
 H_2O ;
a chelating agent; and,
a surfactant;

after cleaning said wafer, drying said wafer; and
wherein said processing is done within 3 minutes.

84. (previously presented) A method of processing a wafer comprising:
placing said wafer in a single wafer cleaning tool;
after placing said wafer in said single wafer cleaning tool, spinning said wafer;
while spinning said wafer, dispensing a cleaning solution comprising:
 NH_4OH ;
 H_2O_2 ;
 H_2O ;
 a chelating agent; and
 a surfactant;
on said wafer;
after dispensing said cleaning solution on said wafer, rinsing said wafer with a first
rinse;
 after rinsing said wafer with said first rinse, dispensing a hydrofluoric acid solution
on said wafer for between 2-3 seconds; and
 after cleaning said wafer, rinsing said wafer with a second rinse.
85. (original) The method of claim 84 wherein said first rinse and said second rinse are
the same solution.
86. (original) A method of processing a wafer comprising:
cleaning said wafer with a cleaning solution comprising:
 NH_4OH ;
 H_2O_2 ;
 H_2O ;
 a chelating agent, and
 a surfactant;
after cleaning said wafer, rinsing said wafer with a first rinse;
after rinsing said wafer with said first rinse, etching said wafer with an HF solution;
after etching said wafer, rinsing said wafer with a second rinse; and
wherein said processing is done within 3 minutes.

87. (original) The method of claim 86 wherein said first rinse and said second rinse are the same solution.

88. (previously presented) A method of processing a wafer comprising:

O₂ ashing a wafer having a first side and a second side, wherein said O₂ ashing is done to said first side of said wafer;

after O₂ ashing said first side of said wafer, cleaning said first side of said wafer with a cleaning solution comprising:

NH₄OH;

H₂O₂;

H₂O;

a chelating agent, and

a surfactant; and

after cleaning said wafer, rinsing said wafer with a rinsing solution.

89. (original) The method of claim 88 wherein said wafer is spun during said processing.

90. (original) The method of claim 88 wherein megasonics are applied to said wafer during said processing.

91. (original) The method of claim 88 further comprising rinsing said first side of said wafer before cleaning said first side of said wafer.

92. (original) The method of claim 88 further comprising rinsing said first side of said wafer after cleaning said first side of said wafer.

93. (original) The method of claim 88 wherein said rinsing solution is ozonated water.

94. (original) The method of claim 88 further comprising drying said wafer after cleaning said wafer by spinning said wafer at speeds between 2000-4000 rpm after rinsing said wafer.

95. (original) The method of claim 88 further comprising simultaneous to cleaning said first side of said wafer, cleaning said second side of said wafer with a solution different from said cleaning solution.

96. (original) A method of processing a wafer comprising:
cleaning said wafer with a cleaning solution comprising:
 NH_4OH ;
 H_2O_2 ;
 H_2O ;
 a chelating agent; and
 a surfactant;
after cleaning said wafer, rinsing said wafer;
after rinsing said wafer, drying said wafer; and
wherein said cleaning, rinsing and drying is done within 2 minutes.

97 – 99 (cancelled)

100. (original) A method of cleaning a wafer comprising:
 placing a wafer in a single wafer cleaning tool;
 after placing said wafer in said single wafer cleaning tool, spinning said wafer;
 while spinning said wafer, dispensing an HF solution on said wafer; and
 after dispensing said HF solution on said wafer, dispensing a cleaning solution
comprising:

NH_4OH ;
 H_2O_2 ;
 H_2O ;
 a chelating agent;
 a surfactant; and
on said wafer.

101. (cancelled)

102. (original) A method of cleaning a wafer comprising:
 placing said wafer in a single wafer cleaning tool;

cleaning said wafer with a cleaning solution comprising:
NH₄OH; and
N,N'-Bis(2-hydroxyphenyl)ethylenediiminodiacetic acid (HPED).

103. (cancelled)

104. (currently amended) A method of cleaning a wafer comprising:
placing a wafer in a single wafer cleaning tool;
cleaning said wafer with a solution comprising:
NH₄OH; and
triethylenetetranitrilohexaacet[[t]]ic acid (TTHA).

105. (cancelled)

106. (original) A method of cleaning a wafer comprising:
placing a wafer in a single wafer cleaning tool;
cleaning said wafer with a solution comprising:
NH₄OH; and
desferriferrioxamin B.

107. (cancelled)

108. (cancelled)

109. (currently amended) The method of claim ~~108~~ 106 wherein megasonics are applied to said wafer during said rinsing.

110. (currently amended) The method of claim ~~108~~ 106 wherein said rinsing solution is applied to a first side of said wafer and a solution different from said rinsing solution is applied to a second side of said wafer.

111. (cancelled)

112. (original) A method of cleaning a wafer comprising:

placing a wafer a in single wafer cleaning tool;
cleaning said wafer with a solution comprising:
NH₄OH; and
molybdic acid.

113 – 121 (cancelled)